PAN PAC™ FOREST PRODUCTS LTD | 50 YEARS & GROWING

Pan Pac Forests Public Monitoring Summary 2026

Photo: Adult koaro *Galaxias brevipinnis* in the Pākuratahi Stream, Tangoio Forest

Contents

1. Introduction

The purpose of this report is to describe the range and general results of monitoring programmes that are undertaken by Pan Pac Forest Products Ltd (Pan Pac).

The Public Monitoring Summary is produced as a requirement of Pan Pac's Forest Stewardship Council® (FSC-C017103) (FSC®). This document provides a summary of the key indicators monitored by Pan Pac that are not confidential.

Further information can be provided on request. Please contact Pan Pac Forest Products Ltd via phone (06) 831-0100.

2. What Pan Pac Monitors

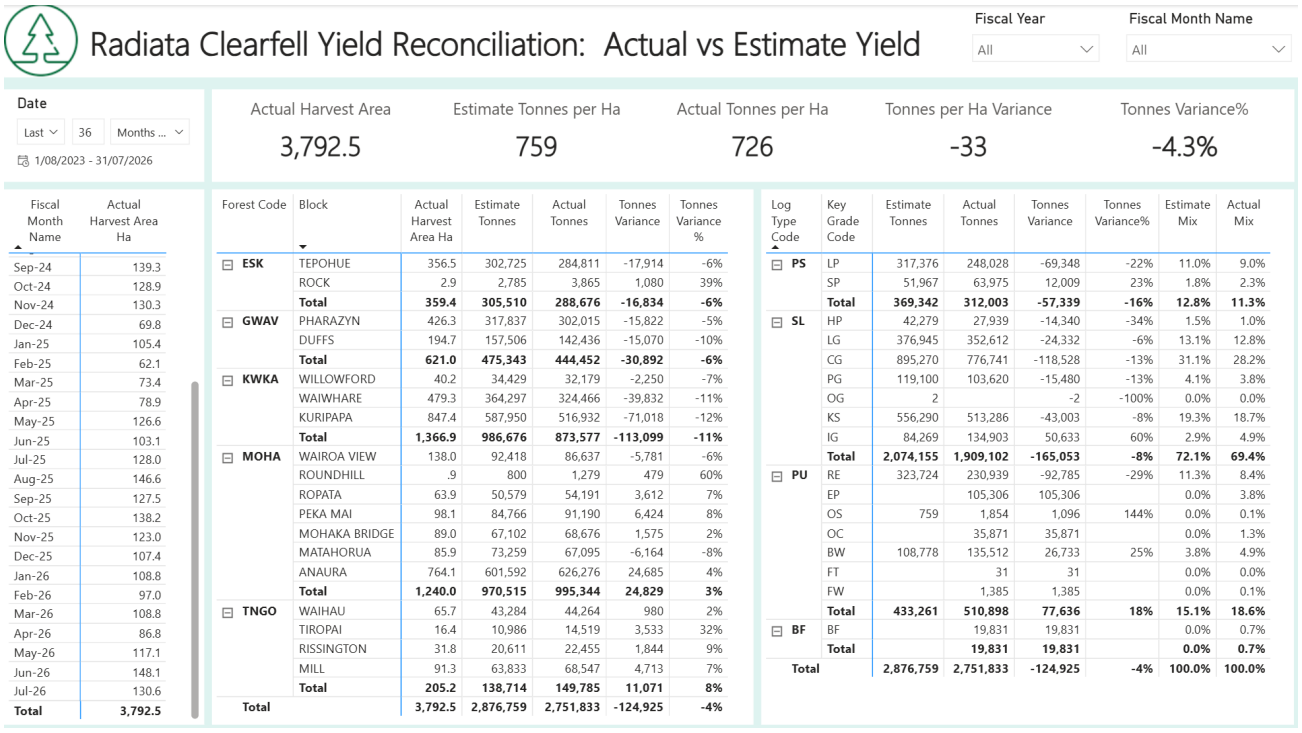
Pan Pac undertakes routine monitoring in a range of areas including:

- Forest Growth and Dynamics
- Forest Health
- Health and Safety
- Workforce
- Biodiversity
- Operations

Key monitoring results are summarised in the attached report. Further results are available on request where they are not confidential.

3. Forest growth and Yield Monitoring

Permanent Sample Plots (PSP's) and Preharvest Inventory are used to monitor the growth of the forest estate to align with our overall production strategy. The summary table below shows a snapshot of our ongoing yield monitoring for the previous 36 months of Clearfell radiata harvest. This compares the actual vs. estimate yield for all *P.radiata* clearfell areas over the period 1st August 2023 to 31st of July 2026. Table 1 below shows the differences in yield by Forest and Block and Log Type and Key Grade.



Radiata Clearfell Yield Reconciliation: Actual vs Estimate Yield

Fiscal Year: All | Fiscal Month Name: All

Date: Last 36 Months ... 1/08/2023 - 31/07/2026

Actual Harvest Area	Estimate Tonnes per Ha	Actual Tonnes per Ha	Tonnes per Ha Variance	Tonnes Variance%
3,792.5	759	726	-33	-4.3%

Fiscal Month Name	Actual Harvest Area Ha
Sep-24	139.3
Oct-24	128.9
Nov-24	130.3
Dec-24	69.8
Jan-25	105.4
Feb-25	62.1
Mar-25	73.4
Apr-25	78.9
May-25	126.6
Jun-25	103.1
Jul-25	128.0
Aug-25	146.6
Sep-25	127.5
Oct-25	138.2
Nov-25	123.0
Dec-25	107.4
Jan-26	108.8
Feb-26	97.0
Mar-26	108.8
Apr-26	86.8
May-26	117.1
Jun-26	148.1
Jul-26	130.6
Total	**3,792.5**

Forest Code	Block	Actual Harvest Area Ha	Estimate Tonnes	Actual Tonnes	Tonnes Variance	Tonnes Variance %
ESK	TEPOHUE	356.5	302,725	284,811	-17,914	-6%
	ROCK	2.9	2,785	3,865	1,080	39%
	Total	**359.4**	**305,510**	**288,676**	**-16,834**	**-6%**
GWAV	PHARAZYN	426.3	317,837	302,015	-15,822	-5%
	DUFFS	194.7	157,506	142,436	-15,070	-10%
	Total	**621.0**	**475,343**	**444,452**	**-30,892**	**-6%**
KWKA	WILLOWFORD	40.2	34,429	32,179	-2,250	-7%
	WAIWHARE	479.3	364,297	324,466	-39,832	-11%
	KURIPAPA	847.4	587,950	516,932	-71,018	-12%
	Total	**1,366.9**	**986,676**	**873,577**	**-113,099**	**-11%**
MOHA	WAIROA VIEW	138.0	92,418	86,637	-5,781	-6%
	ROUNDHILL	.9	800	1,279	479	60%
	ROPATA	63.9	50,579	54,191	3,612	7%
	PEKA MAI	98.1	84,766	91,190	6,424	8%
	MOHAKA BRIDGE	89.0	67,102	68,676	1,575	2%
	MATAHORUA	85.9	73,259	67,095	-6,164	-8%
	ANAURA	764.1	601,592	626,276	24,685	4%
	Total	**1,240.0**	**970,515**	**995,344**	**24,829**	**3%**
TNGO	WAIHAU	65.7	43,284	44,264	980	2%
	TIROPAI	16.4	10,986	14,519	3,533	32%
	RISSINGTON	31.8	20,611	22,455	1,844	9%
	MILL	91.3	63,833	68,547	4,713	7%
	Total	**205.2**	**138,714**	**149,785**	**11,071**	**8%**
Total		**3,792.5**	**2,876,759**	**2,751,833**	**-124,925**	**-4%**

Log Type Code	Key Grade Code	Estimate Tonnes	Actual Tonnes	Tonnes Variance	Tonnes Variance%	Estimate Mix	Actual Mix
PS	LP	317,376	248,028	-69,348	-22%	11.0%	9.0%
	SP	51,967	63,975	12,009	23%	1.8%	2.3%
	Total	**369,342**	**312,003**	**-57,339**	**-16%**	**12.8%**	**11.3%**
SL	HP	42,279	27,939	-14,340	-34%	1.5%	1.0%
	LG	376,945	352,612	-24,332	-6%	13.1%	12.8%
	CG	895,270	776,741	-118,528	-13%	31.1%	28.2%
	PG	119,100	103,620	-15,480	-13%	4.1%	3.8%
	OG	2		-2	-100%	0.0%	0.0%
	KS	556,290	513,286	-43,003	-8%	19.3%	18.7%
	IG	84,269	134,903	50,633	60%	2.9%	4.9%
	Total	**2,074,155**	**1,909,102**	**-165,053**	**-8%**	**72.1%**	**69.4%**
PU	RE	323,724	230,939	-92,785	-29%	11.3%	8.4%
	EP		105,306	105,306		0.0%	3.8%
	OS	759	1,854	1,096	144%	0.0%	0.1%
	OC		35,871	35,871		0.0%	1.3%
	BW	108,778	135,512	26,733	25%	3.8%	4.9%
	FT		31	31		0.0%	0.0%
	FW		1,385	1,385		0.0%	0.1%
	Total	**433,261**	**510,898**	**77,636**	**18%**	**15.1%**	**18.6%**
BF	BF		19,831	19,831		0.0%	0.7%
	Total		**19,831**	**19,831**		**0.0%**	**0.7%**
Total		**2,876,759**	**2,751,833**	**-124,925**	**-4%**	**100.0%**	**100.0%**

Table 1: Actual vs Estimate yield for the period August 2022 – July 2025

4. Forest Health Monitoring

4.1. General

The forest estate continues to show recovery from the impacts of Cyclone Gabrielle, although residual effects remain evident in several blocks. Widespread cyclone debris, earth movement, altered drainage, windthrow and storm-related crown damage continue to influence forest condition, particularly in Esk, Tangoio and Mohaka. In most areas these impacts appear to be stabilising, but they remain important contributors to localised tree stress, debris-associated insect activity and variable performance in younger stands.

Overall forest health was generally satisfactory across the estate. No time-critical observations were reported, and no major new disease issue was identified. The main recurring themes were historic Red Needle Cast effects, low or background levels of Dothistroma, localised Armillaria mortality, ongoing root quality and planting-related issues, and compartment-specific nutrient concerns. Insect activity was largely typical of recently felled, poisoned, burnt, storm-damaged or decaying woody material.

4.2. Forest Health Surveillance

- Surveillance was undertaken by SPS Biosecurity/SPS Biota across the estate, with inspections confirming that the major foliar disease issues observed in previous wet seasons have largely reduced. Dothistroma septosporum was absent or present only at trace to low levels in most forests. Localised post-thinning or post-RNC flare-ups were noted, but these were considered short-lived and of limited economic consequence.
- Red Needle Cast was mostly historic rather than active. Evidence of previous RNC episodes remained common, particularly in Tangoio and Mohaka, where sparse crowns, fluorescence and thinner lower crowns were still apparent. No active RNC episode was observed during the main inspections, although future expression remains possible if winter-spring conditions become favourable.
- Diplodia sapinea was encountered across several forests, generally as a saprophyte or opportunistic coloniser of slash, poisoned stems, storm-damaged material or stressed trees. Localised pathogenic activity was recorded, including a lone pruning-associated canker in Tangoio and top dieback/mortality in parts of Esk associated with wind damage and stand edges.
- Armillaria remained present at low levels across parts of the estate. Mortality was generally isolated and most evident in younger stands, areas with historic hardwood scrub or cutover influence, and poisoned or otherwise stressed trees. In Kaweka and Mohaka, incidences were mostly sporadic, while in Esk the Pohurakura Block continues to show a higher association with previous hardwood scrub cover.
- Root strangulation and poor root architecture remain significant management issues. Tangoio continues to be the most notable example, with ongoing problems in stands established from containerised or root-trained stock. Additional examples were also noted in Kaweka and Mohaka, including toppling, butt sweep, mediocre root systems and planting-related stress.
- Nutrient-related symptoms remain a recurring theme. Kaweka continues to show well-known phosphorus and other nutrient limitations in parts of the forest. Mohaka has suspected boron-related tip failure in Cpt 1000 and recommended nutrient sampling, while Esk NMA showed scattered upper mid-crown yellowing consistent with magnesium deficiency and broader nutrient stress. Sampling should be prioritised where symptoms persist or are linked to growth variability, bud failure or poor recovery.
- Insect activity was generally typical and mostly associated with dead, dying, burnt, poisoned, harvested or cyclone-damaged wood. Common debris-associated insects included Arhopalus ferus, Hylurgus ligniperda, Hylastes ater, Pachycotes peregrinus, Platypus apicalis, Prionoplus reticularis and other native wood borers or decomposers. These were not considered significant threats to healthy standing trees.
- Xenocnema spinipes continues to be noteworthy due to its ongoing range expansion and new southern records. It was recorded in Kaweka, Te Kowhai, Esk and Mohaka, usually in low numbers and associated with woody debris or poisoned material. The insect remains of no known commercial significance, but its spread is useful to continue documenting through routine surveillance.
- Foliage-feeding insects were generally of minor importance. Heliothrips damage was relatively common but low in Tangoio, likely favoured by dry periods and shaded lower foliage. Tortricid and other caterpillar damage was generally light, although Planotortrix excessana was more notable in Mohaka Cpt 1000 where tall grass and weed competition likely supported higher populations.

- Operational and site-related issues remain important contributors to forest health observations. These included variable poison thinning success and non-target poisoning in Mohaka, some unsuccessful ringbarking, fire-damaged material in Esk and Mohaka, and continued effects of cyclone debris and storm damage in parts of Esk and Tangoio.

4.3. Forest-by-Forest Key Points

- **Tangoio:** No noteworthy Dothistroma was recorded and RNC was historic rather than active. Root strangulation remains the key management issue, particularly in previously identified compartments affected by containerised or root-trained stock. Low-level Heliothrips rasping was relatively common on young or shaded foliage but is not expected to become problematic. Deer and goat damage were localised.
- **Esk:** The Esk NMA survey recorded Dothistroma, Cyclaneusma, Armillaria, Diplodia and UMCY/nutrient symptoms, with Dothistroma treatment consideration recommended for susceptible age classes. The Glenfalls, North and Pohurakura survey recorded no management-significant issues, but confirmed ongoing cyclone debris, Armillaria associated with previous scrub influence, trace Dothistroma and typical wood-boring insects. Timely removal of harvested logs from skid sites remains prudent to reduce insect infestation risk.
- **Mohaka:** Forest health was generally stable, with low Dothistroma and historic RNC effects still visible in some stands. Management-significant issues included recommended nutrient sampling in Cpt 1000, suspected boron-related tip failure, Planotortrix damage associated with tall grass, root strangulation/toppling, and variable poison thinning outcomes. Diplodia was common as a saprophyte or opportunist in poisoned stems and may reduce suitability for Sirex colonisation.
- **Kaweka:** Dothistroma levels have returned to typical background levels and RNC was historic only. Armillaria mortality was sporadic and generally low, although individual compartments had incidences approaching 1-2.5%. Poor nutrition remains a key long-term issue, especially in known deficient areas. Some planting/root-quality issues and wind-thrash damage were also recorded in younger stands.
- **Te Kowhai:** The main issue was heavy post-Cyclone Gabrielle debris loading, supporting a range of expected debris-associated insects and fungi. Xenocnema spinipes was confirmed, adding to the southern distribution records before an even further south detection in Kaweka. No major crop health issue was identified.

5. Health and Safety Monitoring

5.1. Pac's Health & Safety performance continues to exceed the industry standard:

- 2023 – Total incidents reported 1394, Pan Pac account for 184
- 2024 – Total incidents reported 874 (16% involving injuries), Pan Pac account for 148 (7% involving injuries).
- 2025 – Total incidents reported 1434 (28% involving injuries), Pan Pac account for 268 (8% involving injuries
- 2026- Total incidents reported 572 (21% involving injuries), Pan Pac account for 51 (2% involving injuries).

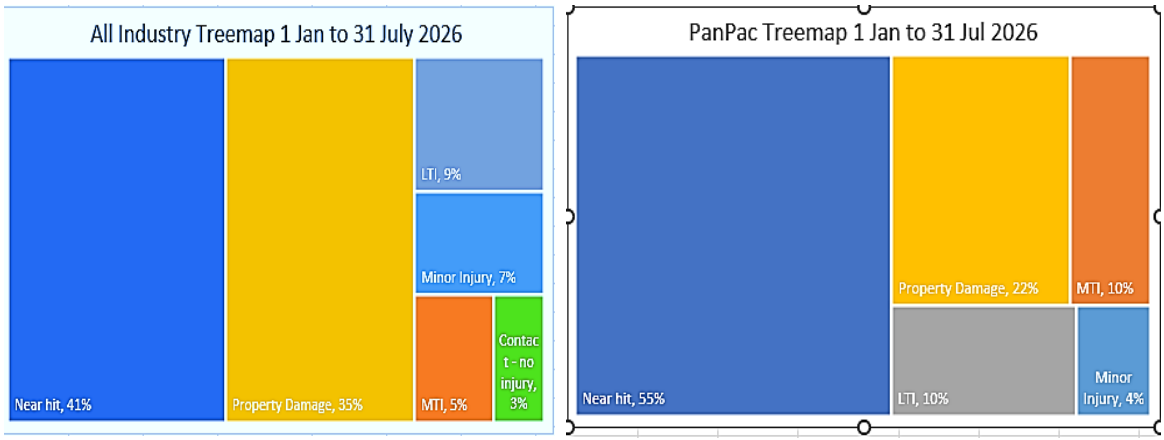


Figure 1: Proportion of incident type from NZ forestry industry (left) and Pan Pac (right) from January – July 2026

Of the industry's 18 notifiable events involving 1996 lost hours, Pan Pac accounted for 6 events with 180 lost hours.

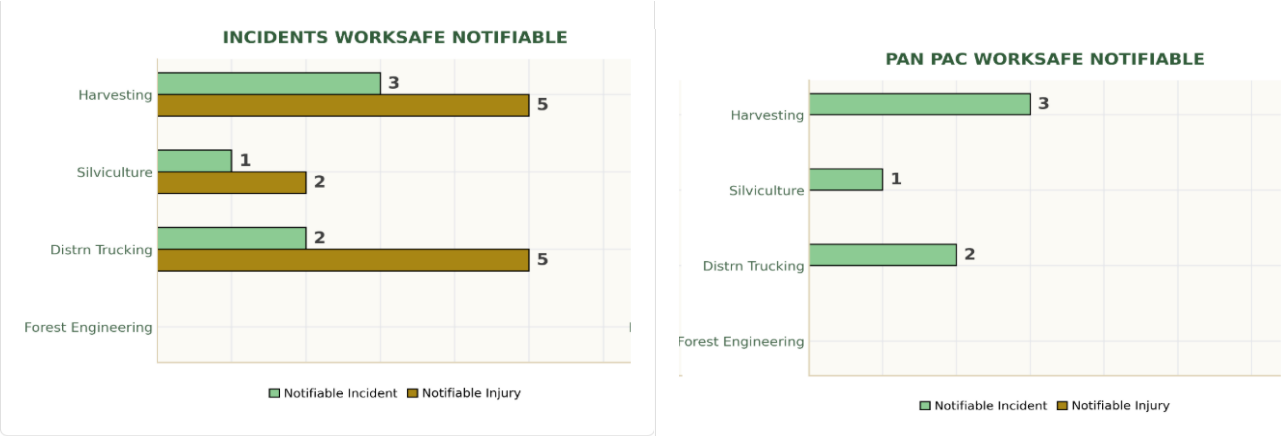


Figure 2: Worksafe notifiable incidents from the NZ forestry industry (left) and Pan Pac (right) from January – July 2026

Pan Pac continues to focus on positive activities to drive Health & Safety outcomes. For the financial year to date (April-July 2026) we have had;

- Health & Safety Monthly Awards: 5
- Health & Safety Recognition: 82??

5.2. <u>Health & Safety Surveys Completed</u>

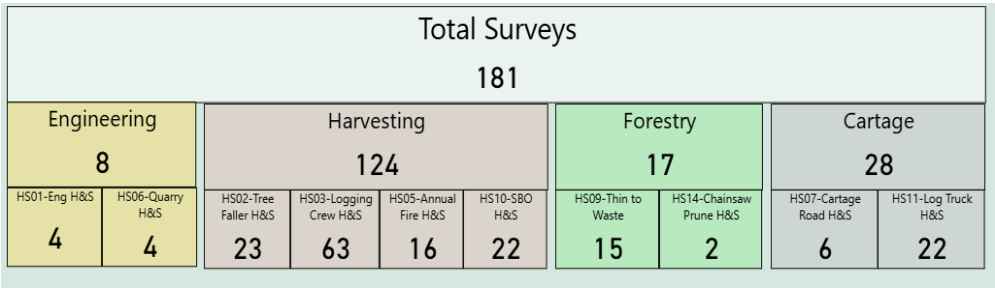


Figure 3: Total Health and Safety surveys completed in the past 12 months

The surveys have identified 187 items that required attention, with only none assessed as serious.

6. Employment

6.1. <u>Workforce Survey</u>

- Forests conducts 5-yearly confidential one-on-one surveys to monitor its workforce. The purpose is to better understand who works for us, how they feel about their work and their feedback on health, safety, wellbeing and environmental issues. These views can be incorporated into how we manage our operations. There have been five surveys conducted, with the most recent being in 2024.
- Methods of completing the survey included in person visits to crews, in person with trucks at the mill site, paper copies handed out and online on survey monkey. The 2024 survey resulted in 236 responses from Harvesting, Silviculture, Cartage, Roading, Log yard/3PY and Forests' staff. It is pleasing to see most (71%) are satisfied or very satisfied with their role and type of work.

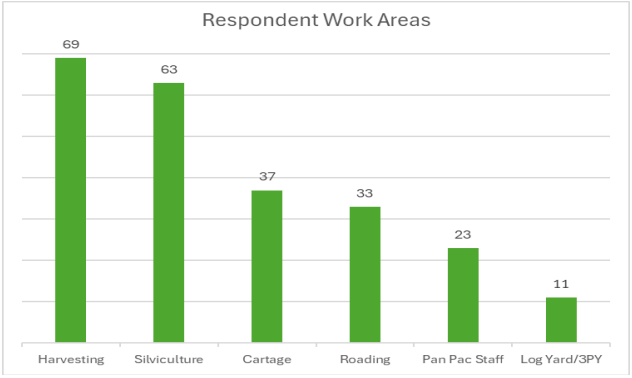


Figure 4: Respondent totals by work area from the 2024 workforce survey

Highlights from the 2024 survey:

- Since 2019, a greater proportion of workers have originated from outside the region.
- 93% of respondents agree that alcohol and drug testing is sufficiently implemented.
- Safety is considered a top priority. Many workers believe that increased training, greater awareness, and improved communication would enhance team safety.
- 71% of the workforce report being satisfied with their job.
- Over half of the workers feel that the public holds a negative perception of the forestry industry.
- Nearly three-quarters of respondents believe their role has an environmental impact.
- The majority of workers are receiving competitive wages.
- The male-to-female workforce ratio of 20:1 remains unchanged since 2019.
- Feedback frequently highlights long travel times contributing to extended workdays.
- The most common age group among workers is 25–34 years.
- The workforce includes a broad range of experience levels: 35% have over 16 years of experience, while 29% have less than 2 years.

7. Biodiversity Monitoring

7.1. Pākuratahi Bush HCV Area

Under FSC® certification, Pan Pac is required to identify and protect High Conservation Values (HCVs)—areas of outstanding environmental, social, or cultural significance. To date, Pan Pac has designated one HCV area: Pākuratahi Bush, an 83-hectare site of remnant and regenerating native forest located north of the Whirinaki mill. This area is managed to preserve its ecological integrity and biodiversity, in line with FSC® standards for responsible forest stewardship.

7.1.1. Pest Monitoring

In 2023, Pan Pac installed 41 DOC 200 traps and 40 bait stations within and around the Pakuratahi QEII HCV area. In 2025, an additional 12 cat traps were added to strengthen predator control efforts. These traps are checked fortnightly during summer and monthly in winter, with rebaiting and clearing carried out as needed. Kill data and bait condition are recorded using the Survey123 app.

Catch data from 2023 to 2026 (Figure 5) show an increase in rats, mustelids, and cats between 2024 and 2025. The 2026 numbers from January to August are broadly in line with the 2023 and 2024 full-year totals, suggesting that total catches may again show another year of increased numbers by December. However, anecdotal reports from contractors suggest that most of this increase is occurring in perimeter traps, while catch rates in the core area of the block are declining. This may indicate improved suppression within the block, although a longer monitoring period is required to confirm trends.

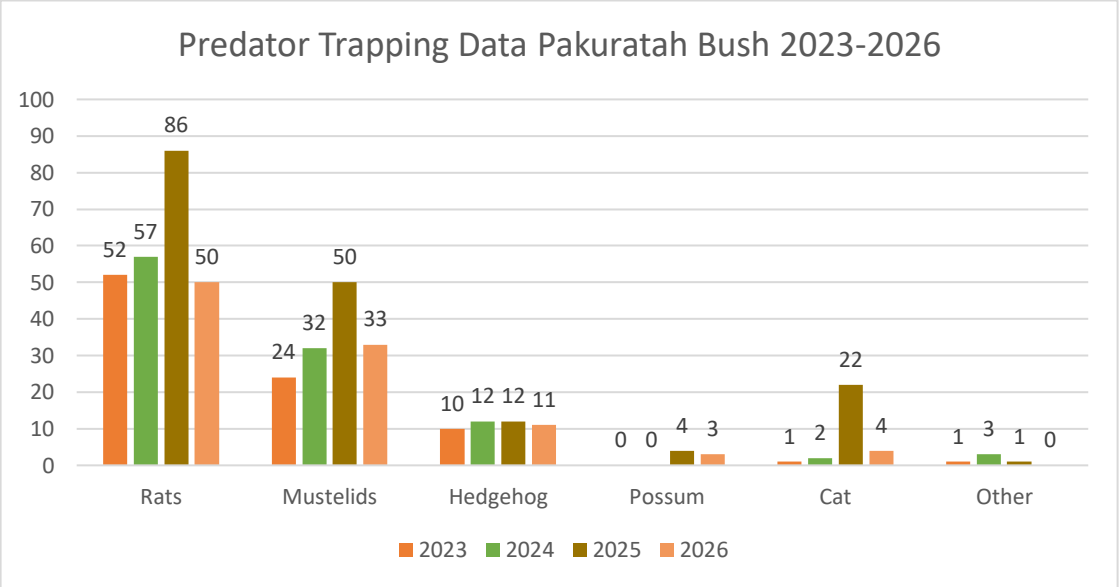


Figure 5: Catch data from Pakuratahi Bush traps from 2023- present. Note 2026 data as from January to August

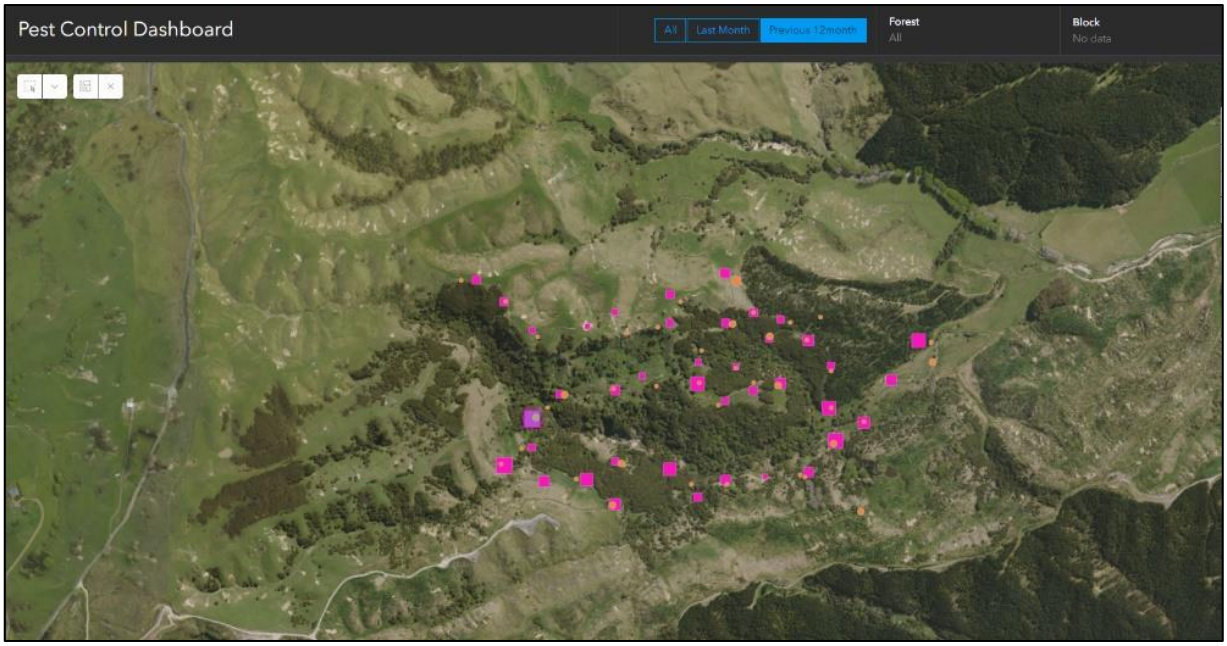


Figure 6: Predator traps (pink squares) and bait stations (orange dots) in the Pakuratahi HCV area. The size of the square relates to how many kills have been recorded at that location

The area was deer fenced in 2022, and targeted culling has removed all deer and goats from the block. Re-incursion of goats and deer happened after Cyclone Gabrielle, when several slips took out sections of the fence. Renewed pest control efforts removed these animals. To monitor the success of this, two trail cameras were deployed and rotated at various locations within the fenced Pakuratahi HCV area to monitor for the presence of pest ungulates such as deer and goats. Over a 57-day deployment period, no ungulates were detected within the block. One camera positioned near an old game trail just inside the fence did capture deer activity outside the fence line, reinforcing the importance of regular fence inspections. In addition to camera monitoring, likely entry points and tracks are routinely checked for hoof prints during site visits, with no signs of deer or goat presence observed to date.

Figure 7: Peacocks and pheasants were the only species detected by trail cameras in the block (above). The only deer captured were patrolling the fenceline outside the block (below).

7.1.2. Photo Points

Seven photopoints were set up in 2021 in order to capture the regeneration of plant species in the absence of browsing mammals such as deer and goats. In August 2024 and 2026 these were revisited. The images below show significant regeneration of kawakawaka *Piper excelsum*, tikotki *Alectryon excelsus* and ongaonga *Urtica ferox.*

Figure 8: Photo points from the Pākuratahi HCV area showing regeneration of native vegetation between the 2021 photos (left), 2024 (Middle) and 2026 (right).

7.1.3. Species List / Walkthrough

In August 2024, Pan Pac and QEII NZ hosted a field day to the Pākuratahi HCV area. Attendants included members of the Hawke's Bay Forest and Bird branch, the Hawke's Bay Botanical Society, Hawkes Bay Farm Foresters and representatives from Te Wai Mauri Nursery. Multiple members noted the plant species they came across, and a species list was populated for the block.

A total of 71 species were recorded, 49 natives and 22 exotics: Trees: 19; Shrubs: 4; Composite Herbs: 5; Non-Composite Herbs: 11; Ferns: 14; Orchids: 1; Lianes (Vines): 9; Grasses, Sedges, Rushes: 8.

Two rare species were identified from the visit, the New Zealand Cucumber or Mawhai *Sicyos australis*, and the New Zealand Snapdragon *Jovellana sinclairii.*

Figure 9: An excellent turnout of plant enthusiasts at the Pākuratahi field day.

Figure 10: New Zealand Cucumber or Mawhai Sicyos australis, climbing ferns (foreground) and kanuka (background). This was found in a visit with HBRC in 2025.

7.1.4. Fence Condition

As previously mentioned, the deer fence at Pākuratahi suffered damage in several locations as a result of Cyclone Gabrielle. Numerous holes appeared where slips occurred and streams blew sections out along the Southern and North Western Boundaries. Due to a combination of contractor shortages and ground conditions preventing access, the repairs were only completed in September 2024. Damage assessments were completed in August 2023, and a post repair assessment was completed in September 2024.

Figure 11: Repaired section of deer fence in the Pākuratahi HCV / QEII block. This was a significant blow out and required extensive woody debris removal.

In January 2025, the fence line was walked with Pan Pac, QEII trust and HBRC staff members. All fences and floodgates were in working order. Several wilding pines were also removed.

In August 2026, 4 small goats were seen in the block. They were successfully culled the next week and a small hole under the fence nearby was patched up.

Figure 12: Troy Duncan (QEII) and Nathan Alexander (HBRC) remove wilding pines during an annual fence inspection at Pakuratahi

7.1.5. eDNA

In February 2024, a 6 rep eDNA sample was taken in the Fishers Native stream which drains the Pākuratahi HCV / QEII area (Figure 13). Five fish species were detected, including koaro *Galaxias brevipinnis* and giant bully *Gobiomorphus gobioides.* Eight bird species were detected, including Tui *Prosthemadera* novaeseelandiae, Kereru *Hemiphaga novaeseelandiae*, grey warbler *Gerygone igata* and Kōtare / Sacred kingfisher *Todiramphus sanctus vagans.*

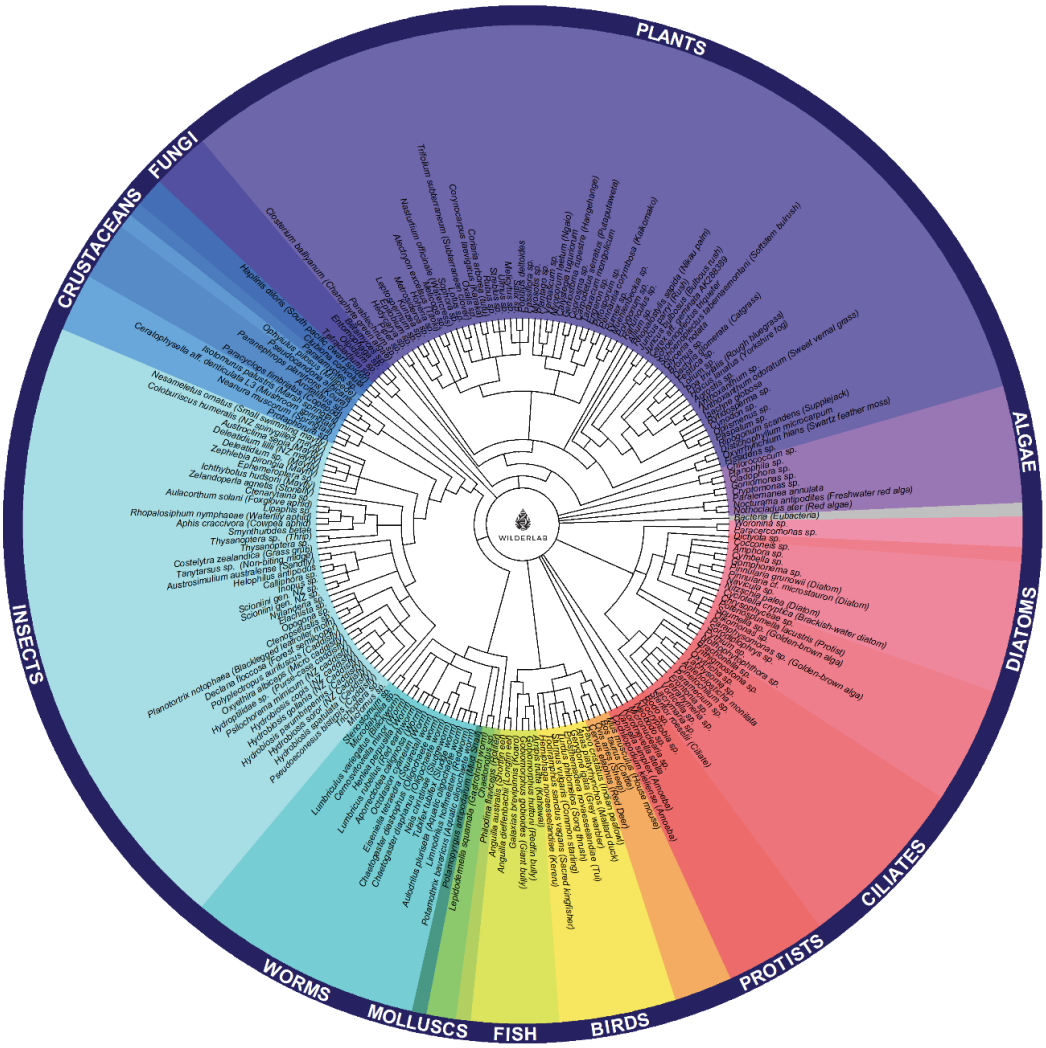


Figure 13: eDNA wheel of life from the Fishers Native Stream which drains the Pākuratahi HCV area

7.1.6. Macroinvertebrates and fish

See sections 9.1 and 9.2 for *Fishers native* fish and macroinvertebrate data.

7.1.7. Moth sampling

A student made three separate visits to Pakuratahi Bush monitor moths as part of their Environmental Management studies. During these visits, they identified over 90 different moth species. Moths and butterflies (Lepidoptera) are important contributors to ecosystem health, playing roles in pollination, decomposition, and supporting food webs. Despite their ecological importance, Lepidoptera are often under-recorded in New Zealand, especially in regions like Hawke's Bay. This kind of monitoring helps build valuable baseline data and supports long-term efforts to track environmental change.

8. Rare, Threatened, Endangered Species Sightings

8.1. Pan Pac maintains a publicly accessible Survey123 app for staff and contractors to record sightings of Rare, Threatened, and Endangered Species. The most frequently observed species is the New Zealand falcon, or Kārearea (*Falco novaeseelandiae*), classified as "At Risk – Recovering" due to habitat loss and other pressures. Although pine forests are not their native habitat, cutover areas support abundant small bird populations—ideal prey for falcons—and slash piles offer suitable nesting sites. Pine plantations provide viable falcon nesting habitat for up to four years post-harvest. However, forestry operations, particularly during the breeding season, can disturb nesting pairs and threaten fledglings. Recording sightings and nesting behaviour is essential for compliance with the Wildlife Act 1953, meeting sustainability goals, and adapting operations to minimise disturbance. Best practice guidelines recommend a 200-meter buffer around active nests from August to March, with remote monitoring preferred to reduce impact. Once fledglings have dispersed, typically by February or March, operations may safely resume.

Figure 14: An adult NZ Falcon or Kārearea spotted in the Waiwhare Block, Kaweka Forest in 2025

In the past 12 months, there have been 36 recorded sightings of NZ falcon in our forests.

Another bird species recorded by our contractors in the past 12 month was banded dotterel *Charadrius bicinctus.* While not seen in our management unit, they inhabit gravel river beaches which is where we occasionally extract gravel for roading in our forests. While the adults are mobile, their nests and young are highly vulnerable to disturbance from vehicle movements and gravel extraction.

In compliance with the NES-CF and resource consent conditions, we contracted ornathologists to conduct bird surveys prior to gravel extraction on the Tutaekuri and Mohaka Rivers in 2024. No nesting behaviour was evident on the Tutaekuri River, but was observed on the Mohaka, and a nest was found. A 100m buffer from extraction and a 30m vehicle buffer was implemented. This will be repeated for planned extractions in summer 2025.

Figure 15: Adult banded dotterel

Figure 16; Spot the eggs. Banded dotterel lay their highly camouflaged eggs in shallow scrapes in the gravel

The New Zealand fernbird (*Poodytes punctatus*) was also recorded twice in the past 12 months, in the Kaweka and Gwavas forests.

Figure 17: Fernbird

9 Stream Monitoring

9.1 Fish Monitoring

Streams in pine plantations can sustain healthy fish populations, with their cool, shaded conditions and reduced sediment input. Often times these streams can sustain fish populations similar to those in native bush streams.

Part of Pan Pac's environmental monitoring includes supporting fish surveys carried out by Hawke's Bay Regional Council (HBRC) in streams across the Pan Pac estate. These surveys use electric fishing and follow the Joy et al. 150m protocol to assess fish populations and stream health. Pan Pac assists with access, logistics, and fieldwork. This collaboration contributes to better understanding and protection of freshwater ecosystems.

Summer 2025 / 2026 sampling (presented as 2026 data) revisted annual monitoring sites in Tangoio forest - Pakuratahi, Tamingimingi and Waipatiki Streams. Two new additional sites were sampled – Dutch Creek in Gwavas and Tore Stream in Esk.

2026 data showed some interannual variability in species diversity and abundance across the annual sites, which is expected. Schooling species such as inanga and smelt are particularly difficult to sample consistently, as they are often either missed entirely or captured in large numbers when a school is encountered. Species with naturally low abundances also have a higher likelihood of non-detection. Eel species can be cryptic and easily evade capture, especially when they burrow into sediment or stream banks. Additionally, some populations may still be recovering from the impacts of Cyclone Gabrielle, which significantly affected instream habitats in certain catchments. Continued long-term monitoring will be helpful to detect and understand these changes over time.

The low koaro catch rate in Pākuratahi Stream in 2026 is notable compared with previous years. However, a separate fish capture and relocation programme undertaken at the same site in April 2026, associated with road works, recorded 16 koaro within a 400 m reach that included the 150 m annual monitoring site. This suggests that koaro remain present in the reach, and that the annual survey result may reflect sampling variability rather than a clear decline in abundance.

Another notable 2026 finding was the capture of three adult koaro in Tore Stream above a perched culvert (Figure X). Koaro are migratory, beginning their upstream migration from the Mohaka River mouth as whitebait and travelling more than 80 km inland to this site. Given the current perched condition of the culvert, it is unlikely that these adult fish were able to pass through it under normal flows, and flood flows are likely to create velocities too high for effective passage. The absence of smaller juvenile fish also suggests that a bed-movement event, possibly associated with Cyclone Gabrielle, may have altered the culvert outlet and restricted recent recruitment. A rubber ramp has been installed at the outlet to improve fish passage, and the site will be resurveyed during the 2026/2027 summer to determine whether new recruits are able to re-enter the stream.

Table 1: ***Results from Electric Fishing surveys with HBRC between 2024 and 2026***

Freshwater Fish Survey Results

Rows are colour-coded by survey year: 2024 blue • 2025 green • 2026 gold. Blank cells indicate no recorded count.

Forest	Site	Year	Black Flounder	Bluegill Bully	Common Bully	Common Smelt	Crans Bully	Dwarf Galaxias	Inanga	Koaro	Koura	Longfin Eel	Rainbow Trout	Redfin Bully	Shortfin Eel	Torrentfish
Tangoio	Fishers Native Stream	2024									9	1		14		
		2025									4			5	2	
Tangoio	Tamingimingi Stream	2024		3			1					16		51	25	
		2025							62		2	4		25	6	
		2026		1					96		4	16		82	13	1
Tangoio	Pākuratahi Stream	2024								12	2	3		19	1	
		2025				3				8	1	5		7	2	
		2026							1	1		8		70	3	3
Tangoio	Te Ngarue Stream	2024		1					1	1		8		60	28	
		2025	1		1	21			53	1	1	10	1	64	25	17
Tangoio	Waipatiki Stream	2024								3	2	12	35		62	5
		2025							7	4	6	7		47	36	7
		2026			88	2			4	4	15	29		79	47	12
Gwavas	Dutch Creek	2026					4	4				9	98	21	3	
Esk	Tore Stream	2026								3						

Figure 18: Electric fishing survey in the Pākuratahi Stream with HBRC (background), and male redfin bully (foreground)

9.2 Macroinvertebrates

As with fish mentioned earlier, pine plantation streams can offer good habitat for aquatic life. Their cool, clean, and low-sediment waters often support healthy populations of macroinvertebrates—small aquatic creatures like insects, snails, and worms that are excellent indicators of stream health.

However, studies from New Zealand, including the Pakuratahi catchment and others, show that macroinvertebrate communities typically decline following forest harvesting. This is due to increased sedimentation, loss of canopy cover, and habitat disturbance. Sensitive taxa such as mayflies, stoneflies, and caddisflies are often replaced by more tolerant species like midges and worms. Fortunately, recovery is generally observed within a few years, especially once riparian vegetation is re-established. The presence of canopy cover—whether native or exotic—is a key factor in supporting the return of more diverse and sensitive macroinvertebrate communities.

To better understand these patterns, Pan Pac began a long-term monitoring programme in 2024/25 to assess how forestry operations—particularly harvesting—affect stream ecosystems. By focusing on macroinvertebrates, we can track changes in water quality and habitat over time. These organisms respond quickly to environmental shifts, so monitoring which species are present (and in what numbers) helps us detect any impacts early.

To assess stream health, we use the Macroinvertebrate Community Index (MCI), a New Zealand-developed scoring system. Each species is rated from 1 to 10 based on its sensitivity to pollution—higher scores indicate cleaner water. The overall site score provides a snapshot of stream condition and is grouped into bands under the National Policy Statement for Freshwater Management (NPSFM) 2020, as shown in Table 3.

Band	MCI Score	Ecological Condition
A	≥ 130	Macroinvertebrate community indicative of pristine conditions with almost no organic pollution or nutrient enrichment.
B	≥ 110 and < 130	Indicative of mild organic pollution or nutrient enrichment. Largely composed of pollution-sensitive taxa.
C	≥ 90 and < 110	Indicative of moderate organic pollution or nutrient enrichment. Mix of sensitive and tolerant taxa.
National Bottom Line	90	Minimum acceptable condition under national guidelines.
D	< 90	Indicative of severe organic pollution or nutrient enrichment. Dominated by pollution-tolerant taxa.

Table 3: MCI national bands from the National Policy Statement for Freshwater Management 2020

Our sampling design involves monitoring a select number of stream sites at three key time points: before harvesting, one year after harvesting, and five years post-harvest. This timeline allows us to capture both short-term and longer-term ecological responses to forest management activities.

Sampling was carried out using the Stark et al. protocol, with Surber samplers used at hard-bottom sites and kick-net sampling at soft-bottom sites. All samples were preserved in denatured ethanol and processed by a specialist laboratory based in Taupō, using a fixed-count method of 200 individuals per sample. This standardised approach enables consistent comparisons across sites and years.

Studies from New Zealand, including the Pakuratahi catchment and others, show that macroinvertebrate communities typically decline following forest harvesting due to increased sedimentation, loss of canopy cover, and habitat disturbance. Sensitive taxa such as mayflies, stoneflies, and caddisflies are often replaced by more tolerant species like midges and worms. However, recovery is generally observed within a few years, especially once riparian vegetation is re-established. The presence of canopy cover—whether native or exotic—is a key factor in supporting the return of more diverse and sensitive macroinvertebrate communities. These findings reinforce the importance of long-term monitoring to understand the pace and extent of ecological recovery and to inform sustainable forest management practices.

Figure 19: Surber sampling macroinvertebrates in the Mangahoi Stream Wairoa View Forest

The 2026 results show very high scores for the Pakuratahi, Fisher Natuve, Kaweka 124 and Korongamairoa streams. The latter 3 being in the top 1% of HBRC sites. It is important to note that achieving an A band rating is exceptionally difficult. In fact, only one river monitored by Hawke's Bay Regional Council (HBRC) currently meets the A band criteria. However, it's crucial to consider that HBRC's data is based on five years of annual sampling (N=5), whereas our results are based on a single sample (N=1).

Next years samples will focus on post harvest sampling of the sites sampled in 2025.

Forest	Site	State	Year	MCI Score	MCI Band	HBRC Comparison
Wairoa View	Mangahoi Trib	Pre Harvest	2025	129	B	Top 2%
Esk	Kings Stream	Post Establishment	2025	109	C	Top 20%
Kaweka	Okatarara Stream	Pre Harvest	2025	127	B	Top 2%
Gwavas	Rock Rd Trib	Pre Harvest	2025	129	B	Top 2%
Tangoio	Pakuratahi Stream	Pre Harvest	2025	122	B	Top 8%
Tangoio	Pakuratahi Stream	Pre Harvest	2026	117	B	Top 11%
Tangoio	Tamingimingi Stream	Farm comparison	2025	111	B	Top 20%
Tangoio	Tamingimingi Stream	Farm comparison	2026	104	C	Top 24%
Tangoio	Fisher Native Stream	Native comparison	2025	125	B	Top 3%
Tangoio	Fisher Native Stream	Native comparison	2026	140	A	Top 1%
Kaweka	Kaweka 124 Stream	Pre Harvest	2026	138	A	Top 1%
Mohaka	Korongamairoa Stream Candy Rd	Pre Harvest	2026	135	A	Top 1%

Table 4: MCI results and bands from sites monitored in summer 2025 and 2026. HBRC comparison colum compares each site's score to the 88 HBRC sites in the 2024 State of Environment Report.

9.2.1 eDNA

Edna is a relatively new and novel water monitoring technique which can identify the presence of a wide range of species through DNA traces left behind in the water. This allows for comprehensive monitoring of aquatic ecosystems, giving insights into biodiversity, including the detection of rare or invasive species. Since eDNA testing can reveal the presence of species sensitive to pollution or environmental changes, it provides valuable data on the health of water bodies potentially affected by forestry operations. A key metric derived from eDNA analysis is the Taxon Independent Community Index (TICI), developed by Wilderlab. TICI is a standardized biodiversity index that quantifies the ecological health of a stream based on the diversity and structure of the detected community. Unlike traditional indices that rely on specific indicator species, TICI uses statistical comparisons to reference conditions, making it applicable across different regions and stream types. Scores range from 0 to 1, with higher values indicating healthier and more diverse aquatic communities In addition, it is a less invasive and more comprehensive technique than traditional biological monitoring like electric fishing and macroinvertebrate sampling.

For Pan Pac Forests, using eDNA results can help track state and trends in water quality over time. Regular sampling enables the monitoring of biodiversity, assessing whether forestry activities like logging or runoff are negatively impacting aquatic ecosystems. This can inform decisions on forest management and ensure compliance with environmental regulations. eDNA testing offers a cost-effective, efficient way to monitor water quality and ecosystem health, supporting both operational needs and environmental sustainability goals.

In 2026, we collected an eDNA sample in the Whirinaki Stream behind the sawmill. Of note was strong eDNA signature for the regionally uncommon banded kokopu. The area was planted in native trees to enhance the ecological values of the stream through increased shading and habitat. All previous results are presented in Table 5 below.

Forest	Stream	Date	Number of Fish	TICI rating	TICI Score
Mohaka	Mangahoi Trib	27/3/2025	3	Good	107.8
Tangoio	Fishers Native (HCV)	1/12/2023	5	Good	100.75
Tangoio	Tamingimingi*	20/02/2024	8	Average	95.83
Tangoio	Pākuratahi	20/02/2024	6	Good	105.8
Esk	Kings Stream	07/03/2025	1	Good	106.7
Kaweka	Otakarara Trib	10/06/2025	1	Excellent	120.9
Gwavas	Rock Rd Trib	01/03/2024	4	Good	106.7
Tangoio	Whirinaki Stream	10/12/2025	6	Average	98.2

*Table 5: Showing fish species detected by eDNA and TICI score for sites within the Pan Pac estate. * The Tamingimingi site is within the Pan Pac Estate, however the catchment is 99% dominated by neighbouring farmland and so results represent this land use.*

9.2.2 Fish Passage

Fish passage is a key component of freshwater management in New Zealand, where many of our native freshwater fish need to migrate between freshwater and marine environments for survival and reproduction. However, many waterways are obstructed by man made barriers like perched culverts (figure 20) or dams, which can delay or prevent migration. Pan Pac employs a contractor to conduct surveys of fish passage at road and stream crossings within our estate.

In the past 2 years months, 162 structures have been assessed. 22 were providing good fish passage, 11 were limited, and 60 were unknown, given the difficulty of assessing the outlet. Concerningly, 74 were assessed as poising a complete or partial barrier to passage. However, it is important to note that many of these will be ephemeral or intermittent stream types providing little or no habitat, therefore remediating these is not a high priority.

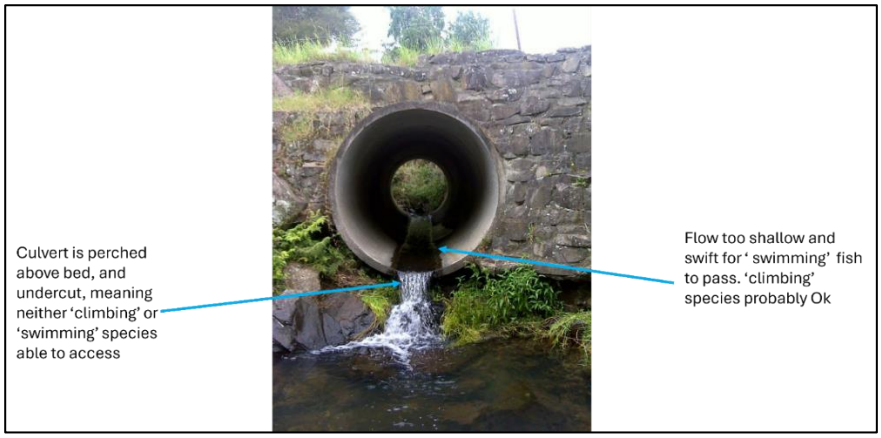


Figure 20: A typical perched culvert showing multiple aspects of barrier to migration. This culvert would be impassable to any fish species

Figure 21: Allen Road culvert, Gwavas Forest. This culvert was replaced after Cyclone Gabrielle, and over- spec'd to a 1-50 year size. This has allowed for the bottom to be embedded, which retains bed material within the culvert and enables passage for both climbing and swimming fish species.

10. Wetlands

10.1. HBRC monitor 3 wetlands across our forest estate, one in Gwavas and two in the Kaweka Forest. Vegetation structure is monitored with a drone flying pre-programmed transects. They measure vegetation plots, recording all species present, their height and foliage cover. Two soil cores are taken and analysed for bulk density and nutrients. Foliage of dominant plant species is taken and also analysed for nutrients. Wetland bird surveys are undertaken. All of this monitoring is intended to be repeated on a 5 year cycle. HOBO water loggers have been deployed at these wetlands and record water level every 30 minutes. The collected data is aggregated with data from other wetlands in the catchment to help us understand the state and trend of wetlands in Hawke's Bay.

FRESHWATER WETLANDS OF TUKITUKI

We have lost 98% of the original wetland extent in Hawke's Bay, while nationally we have lost 90%. Wetlands are one of the most threatened ecosystems today, and we need to know what state the different types of wetlands are in, whether they are improving, or degrading and disappearing. In Winter 2016, with landowners support, HBRC initiated the State of the Environment (SOE) monitoring programme for wetlands in the Tukituki Catchment. Here is the summary of what we have found.

Duff's Flat Wetland

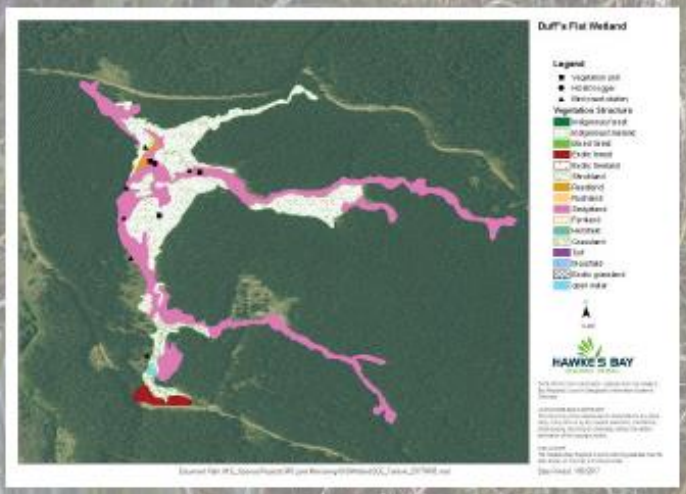
Duff's Flat Wetland is located in the Makaroro sub-catchment of the Tukituki Catchment. Surrounding land is in productive forestry (stand age 20+ years old).

This wetland is a 'fen', which is a wetland with a predominantly peat substrate, but more decomposed state than bogs. Fen is usually fed by rain and groundwater, resulting low to moderate nutrient levels. It mainly occurs on slight slopes such as fans and toes of hillsides. Fen is relatively uncommon in the Tukituki Catchment compared to other types of wetland, such as swamps.

Wetland Facts

Size: **7 ha**
Main vegetation: **Machaerina sedgeland, Manuka shrubland, Raupo reedland**

Vegetation of the wetland is diverse with low sedgeland/reedland to tall manuka shrubland. Such multi-tiered vegetation can often be good habitats for fernbird. Fernbird is a cryptic bird species who favour a dense wetland vegetation. Fernbirds are found at Duff's Flat in good numbers.



Machaerina sedgeland (foreground) and manuka shrubland are two main vegetation types

Fernbird

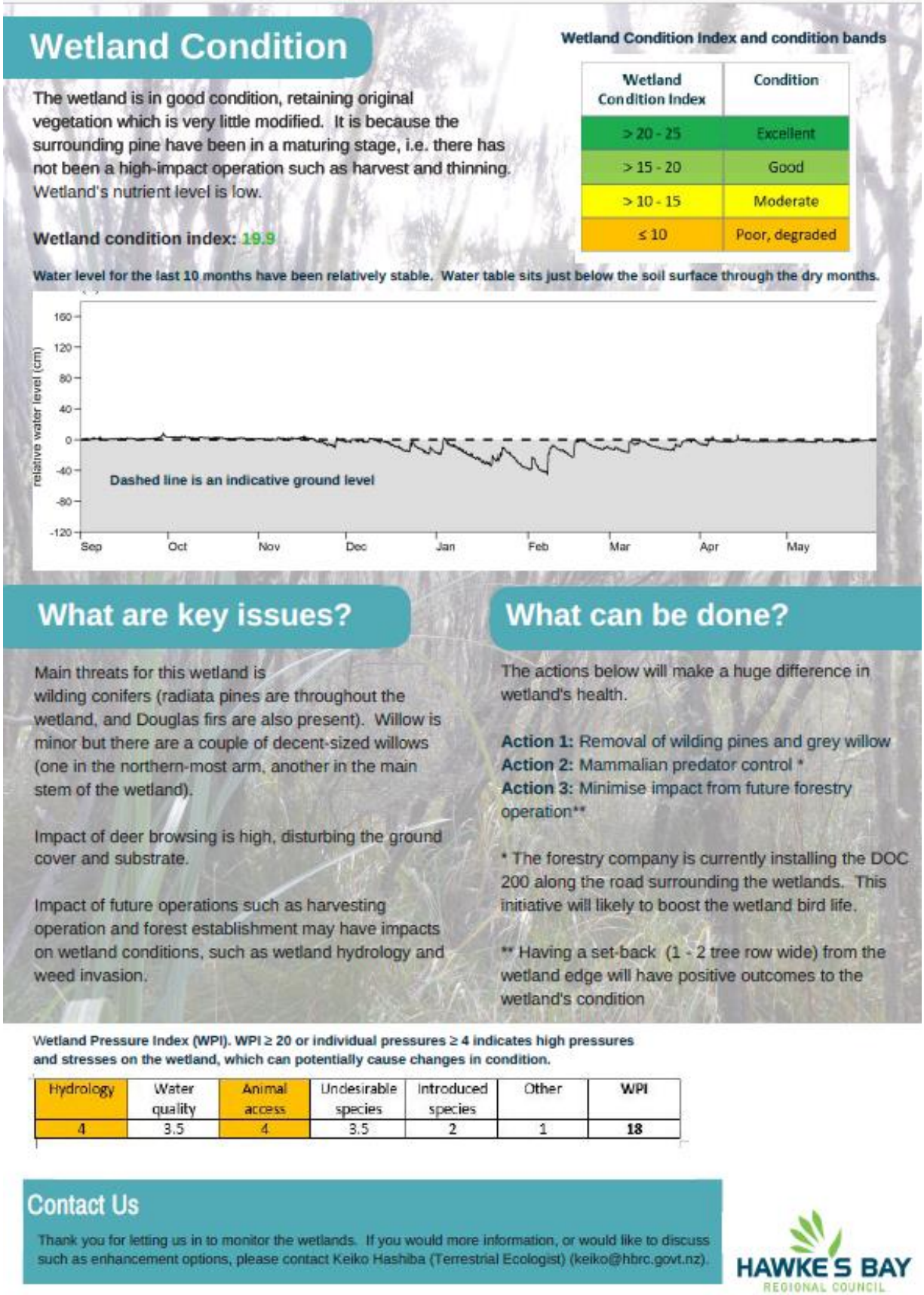


Figure 22: Wetland report card for Duffs wetland, Gwavas forest. Supplied by HBRC

11. Native Permanent Sample Plots

11.1. Pan Pac monitors 12 native permanent sample plots (PSPs) across our forest estate. The first plots were established in 2005, with additional sites being added in 2016. These are visited every 5 years.

Forest	Block	PSP Name	Easting	Northing
Mohaka	Putere	Papa Rd PSP M3	1950857	5676887
		Papa Rd PSP M4	1950949	5676945
Esk	Ohane	Takere RD PSP E3	1908833	5671207
		Paratu Rd PSP E1	1910089	5669980
Tangoio	Mill	Burbury Rd PSP T1	1932355	5638220
Gwavas	Pharazyn	Pickford Rd PSP G1	1891562	5601951
		Pickford Rd PSP G4	1891423	5601949
		Wakarara Rd PSP G3	1888969	5599928
Kaweka	Kuripapango	Castlerock Rd PSP K3	1891574	5635662
		Castlerock Rd PSP K4	1891624	5635605

Table 6: Native PSPs in the Pan Pac forest estate

Figure 23: Pan Pac Environmental Advisor measuring the diameter of a Kahikatea tree in Gwavas Forest

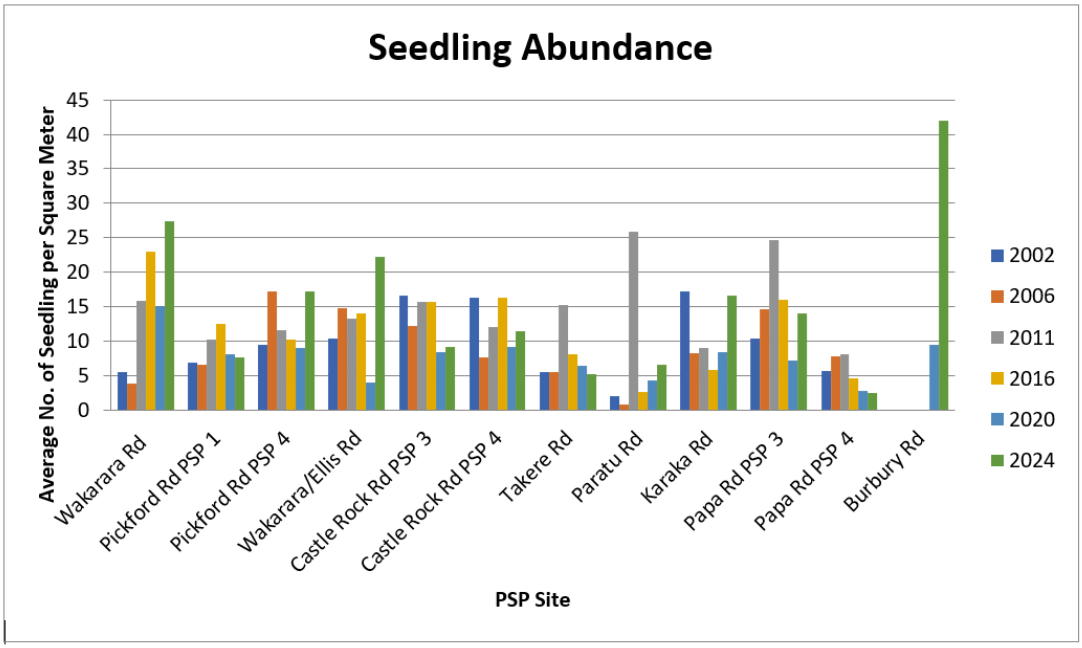


Figure 24: Seedling abundance at the 12 PSP sites.

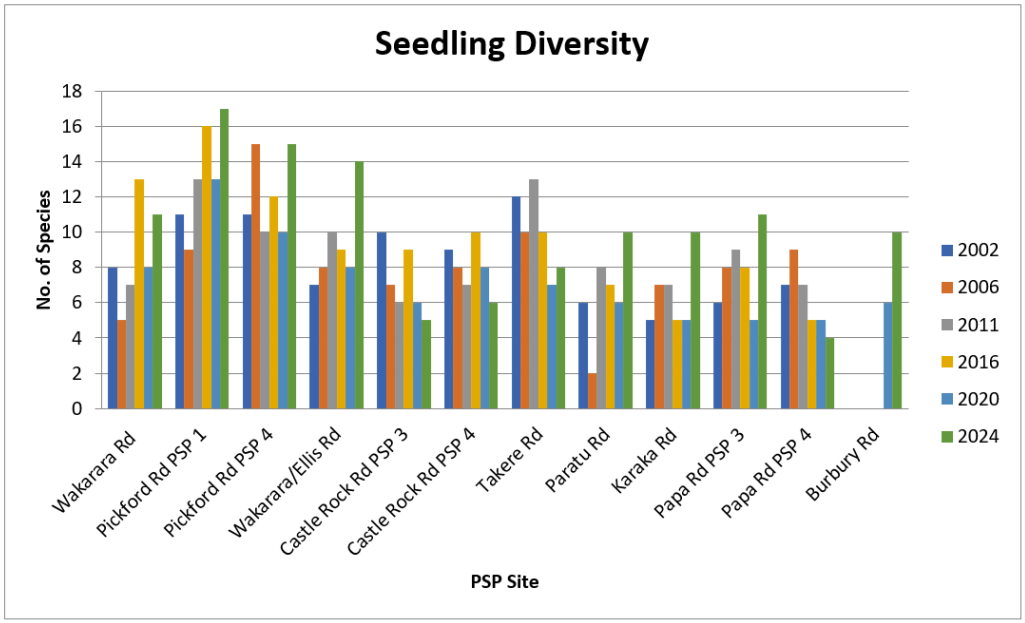


Figure 25: Seedling diversity at the 12 PSP sites.

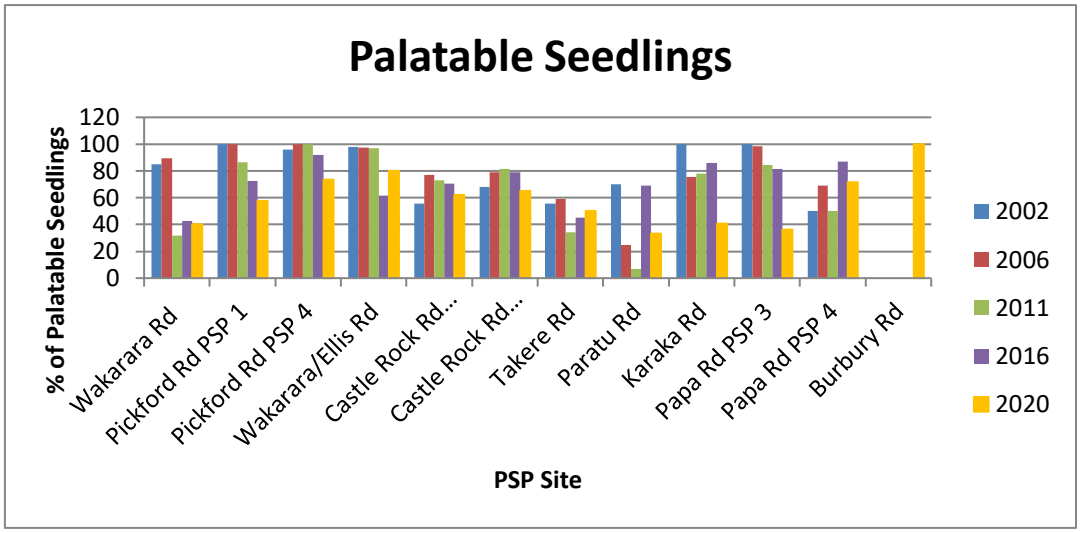


Figure 26: Number of palatable seedlings at the 12 PSP sites. Note: data from 2024 is absent as surveys are incomplete

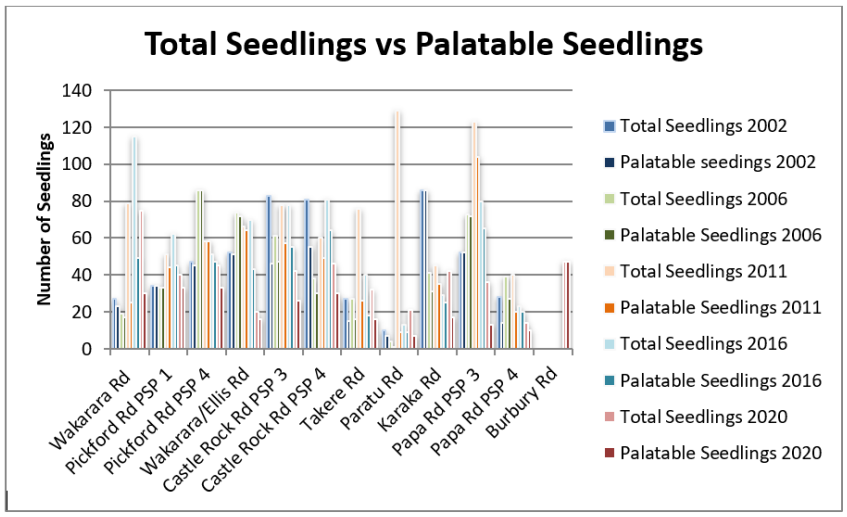


Figure 27: Total vs palatable seedlings at the 12 PSP sites. Note: data from 2024 is absent as surveys are incomplete

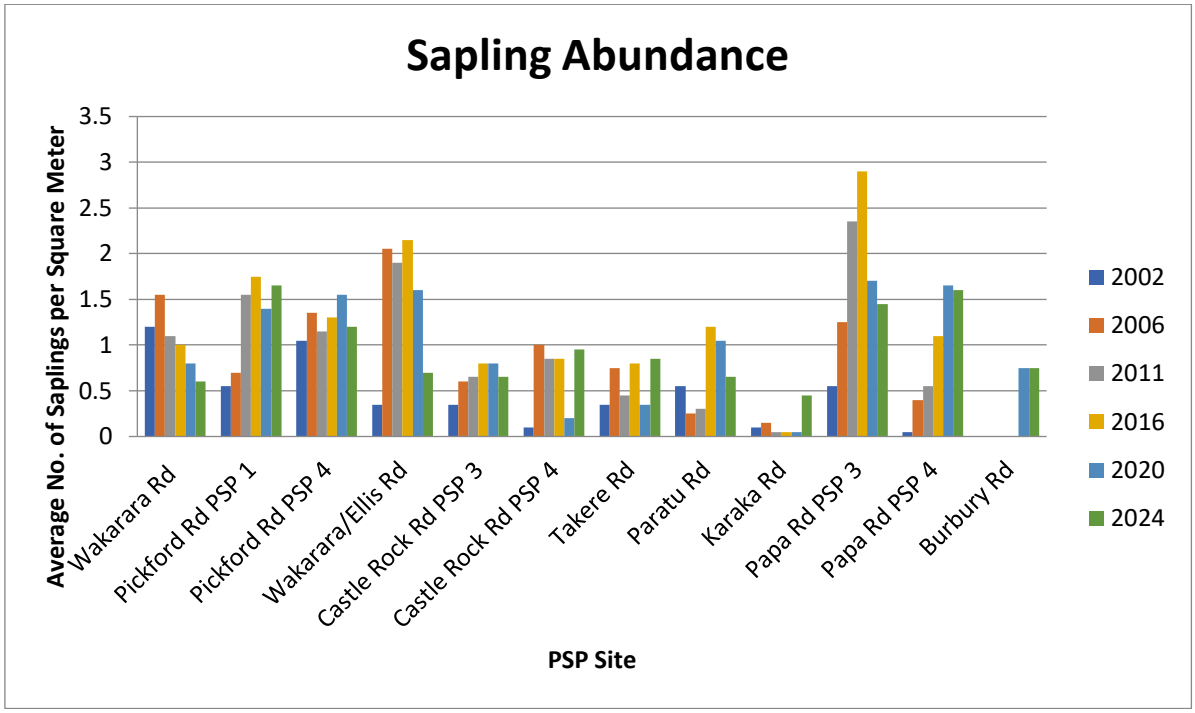


Figure 28: Sapling abundance at the 12 PSP sites.

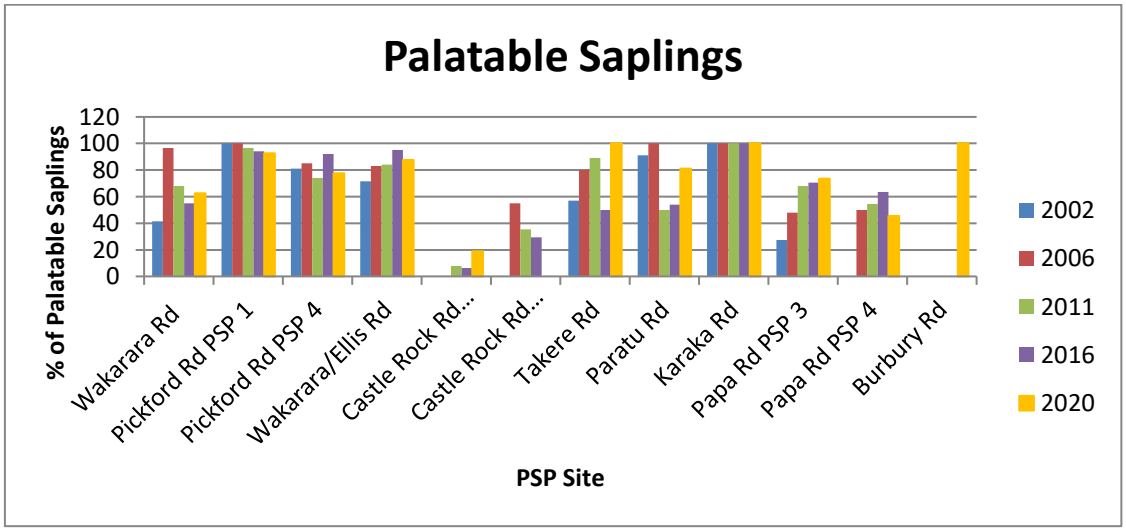


Figure 29: Palatable seedlings at the 12 PSP sites. Note: data from 2024 is absent as surveys are incomplete

Figure 30: Deer enclosure plot at the Castlerock PSP site. Note the extensive regrowth of palatable seedlings inside the plot

12. Transitional Forestry Trials

Pan Pac currently employ a PHD student who are doing their thesis on transitional forestry. Trial sites have been set up in Gwavas Forest.

Forest transitions present an opportunity to retire areas of plantation forest without having to harvest the whole stand and expose potentially erodible soil. It could help to increase the areas of native reserves within forest estates and provide more habitat for native birds and insects throughout the forest matrix.

There is currently a lot of interest in the forestry sector in transitioning exotic pine forest to native forest due to social, economic, and environmental factors. However, many questions remain around how to achieve this, what level of management intervention will be required, and what sites are appropriate to attempt a transition. This project focuses on the management interventions of canopy manipulation with timber recovery, and intensive pest control.

The outcome of this project will be a recommendation on what strip width gives the best results for native seedling growth, passive native regeneration, and least invasion of weed species. As half of each strip is enclosed in a deer fence, we will also be able further research the effects of herbivory on native regeneration and make a recommendation on the level of pest control which may be required for forest transitions.

The canopy manipulation trial was set up in winter 2022. A total area of 1 ha was felled in strips of varying widths and a deer fence was erected around half of each strip. The strips were then planted at 2,500 stems/ha with an even mixture of black beech (*Fuscospora solandri*), mānuka (*Leptospermum scoparium*), and tōtara (*Podocarpus totara*) seedlings. Every seedling planted was tagged and measured for height and root collar diameter to establish a baseline to measure growth against.

Every six months the height and root collar diameter are measured for all the seedlings. This has been ongoing since the trial was established in July 2022. Data loggers were installed in the center of each strip in February 2024. These are recording the light, temperature and relative humidity in each strip over a period of one year. Data from this trial will be analysed in early 2025.

Figure 31: Height (left) and root collar diameter are measured in the trails

Figure 32: Transitional forestry trial site in Gwavas Forest

13. Operation Monitoring

13.1. Contractors are issued with a job prescription and site risk assessment for forest operations. As well as specific requirements in the prescription, contractors are required to comply with the Forest Operations Manual, Environmental Standards, and contractual specifications. Our operational coordinators are required to undertake routine and final environmental assessments. The Survey123 platform (ArcGIS) is used. These results are then signed off with the Contractor. The results of monitoring are recorded in a database. Non-compliance is followed up and corrective actions assigned and signed off when complete. Our environmental monitoring provides comprehensive information on environmental compliance and any impacts that may have occurred on site. Environmental monitoring data is reviewed by the Environmental Advisor, operational managers and their respective health, safety and environmental operational committees. Results are able to be interrogated and displayed via ArcGIS Dashboard.

Our staff are also involved in the direct supervision of contractor operations. Contractors are visited regularly as part of the forest management and supervision process. Contractors' performance is checked against weekly and monthly targets and contractual standards, and discussed as necessary. Monitoring is based on compliance with contract specifications and against a known checklist. This allows our coordinators to provide additional assurance that health, safety and environmental impacts are mitigated in a timely manner. Contractors carry out their own quality control as a check against the independent quality control checks.

From an operational perspective, using monitoring data has resulted in a more accurate and transparent record of performance, improved yield calculations, improved harvest planning, improved environmental alerts and improved health, safety and environmental systems. Monitoring of operational costs are also incorporated into planning for future budgets.

Operational managers meet with contractors regularly to discuss performance.